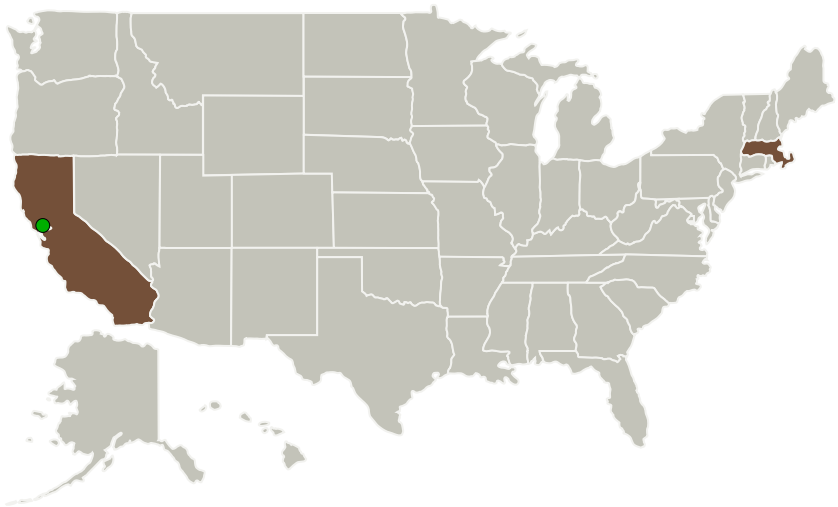
Robotic Arm for Assistive Free-Flyers, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

Energid Technologies proposes a lightweight kinematically redundant robot arm and software toolkit to extend the capabilities of Assistive Free-Flyers (AFFs). The arm will leverage Energid's existing design actuated with modified smart servos to reduce cost and weight and improve performance. A unique feature of the arm is universal end-of-arm-tooling interface that provides extensibility through standard mechanical, data, and power connectors. This interface will allow the arm to host a variety of sensors and tools for broad application. Energid's Actin software toolkit will be extended for control and simulation of AFFs with attached manipulators. Control techniques will be developed to enable novel modes of acrobatic maneuvering and whole-body manipulation. This control and simulation capability will apply to one or multiple arms attached to an AFF. The new control modes will enable use of the arms in perching and momentum conserving acrobatics, where the arm and thrusters are simultaneously actuated to reach a goal. The Actin simulation engine, which supports articulated dynamics, contact dynamics, and sensors, will be extended to include aerodynamics and thruster models for AFF design validation, mission planning, and testing. The new arm and toolkit will seamlessly transition between simulating terrestrial mobile robots and fielded AFFs in microgravity.

Primary U.S. Work Locations and Key Partners



Robotic Arm for Assistive Free-Flyers, Phase I

Table of Contents

Robotic Arm for Assistive Free-Flyers, Phase I

Completed Technology Project (2015 - 2015)

Organizations Performing Work	Role	Type	Location
Energid Technologies	Lead Organization	Industry	Cambridge, Massachusetts
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

June 2015: Project Start

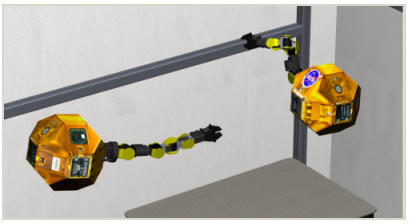
December 2015: Closed out

Closeout Summary: Robotic Arm for Assistive Free-Flyers, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139412)*

Images



Briefing Chart Image
Robotic Arm for Assistive Free-Flyers, Phase I
(https://techport.nasa.gov/image/134905)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Energid Technologies

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

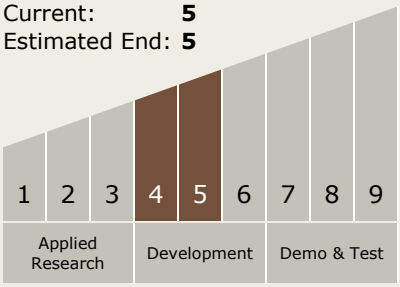
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Douglas E Barker

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



Robotic Arm for Assistive Free-Flyers, Phase I

Completed Technology Project (2015 - 2015)

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.3 Manipulation
    - TX04.3.3 Contact Dynamics Modeling

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System